Software Rights Archive, LLC v. Google Inc. et al Doc. 166

EXHIBIT 1

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UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN JOSE DIVISION

APPLE IPOD ITUNES ANTI-TRUST LITIGATION	Lead Case No. C-05-00037-JW

Declaration of Roger G. Noll

My name is Roger G. Noll, and I reside in Palo Alto, California. My education includes a B. S. with honors in mathematics from the California Institute of Technology and a Ph. D. in economics from Harvard University. I am Professor *Emeritus* of Economics at Stanford University, a Senior Fellow in the Stanford Institute for Economic Policy Research (SIEPR), and Co-Director of the SIEPR Program in Regulatory Policy.

My primary area of scholarship is the field of industrial organization, which includes the economics of antitrust, regulation, technology policy, and specific industries. I have taught these subjects at both the undergraduate and graduate level. I am the author, co-author or editor of thirteen books, and the author or co-author of over 300 articles. Much of my research for the past forty years has focused on the entertainment industry, and more recently on antitrust and intellectual property issues associated with the digital revolution. My complete *curriculum vita* is attached as Appendix A.

I have served as a consultant to the Antitrust Division of the U.S. Department of Justice, the U. S. Federal Trade Commission, the Federal Communications Commission, and the Senate Subcommittee on Antitrust and Monopoly. I also have participated on committees of the National Research Council that investigated antitrust and intellectual property issues associated with the rise of digital information technology and the delivery of entertainment products over the Internet, including the Board on Science, Technology and Economic Policy and the Committee on Intellectual Property Rights and the Emerging Information Infrastructure. As a member of the latter, I was co-author of *The Digital Dilemma*, a study of the implications of developments in information technology for the traditional publishing and entertainment industries. I also was a member of the California Council on Science and Technology, for which I organized a study of disparities in access to computers and the Internet that was published by CCST as *Bridging the Digital Divide.*

I have served as an economic expert in previous litigation, some of which involved economic issues associated with digital entertainment technologies and the Internet. During the past five years I have testified at trial in the following cases:

Metropolitan Intercollegiate Basketball Association vs. National Collegiate Athletic Association (U.S. District Court, New York, New York);

Gordon, et al., vs. Microsoft (Superior Court, Hennepin County, Minneapolis, Minnesota);

Seven Network v. News Limited (Federal Court, District of New South Wales, Sydney, Australia);

In Re Tableware Antitrust Litigation (U. S. District Court, San Francisco); and

In the Matter of Adjustment of Rates and Terms for Pre-existing Subscription and Satellite Digital Audio Radio Service (Copyright Royalty Board, Washington, D. C.).

I also testified at an arbitration hearing in a process created by the Federal

Communications Commission to resolve disputes over retransmission agreements between Fox television network and multi-channel video distribution systems:

Echostar Communications vs. News Corporation.

In addition, I have submitted expert reports and/or been deposed in the following other cases that are still pending or have reached conclusion within the last five years:

Coordination Proceedings Special Title, Microsoft Cases I - V (California Superior Court, San Francisco);

Gemstar Patent Litigation (U. S. District Court, Denver);

In Re Napster Copyright Litigation (U. S. District Court, San Francisco);

National Association of Optometrists and Opticians, et al., vs. Lockyer, et al., (U.S. District Court, Sacramento);

Fran Am Partnership vs. Sports Car Clubs of America (U. S. District Court, Denver);

Intertainer vs. Time-Warner, et al. (U.S. District Court, Los Angeles);

Joe Comes, et al., v. Microsoft (District Court for Polk County, Des Moines, Iowa);

In Re Dynamic Random Access Memory (DRAM) Antitrust Litigation (U. S. District Court, San Francisco);

Brian Bock, et al., vs. Honeywell International (Superior Court, San Francisco);

Vincent Fagan and Anthony Gianasca v. Honeywell International (Superior Court for Middlesex County, Boston, Massachusetts);

John McKinnon v. Honeywell International (Superior Court for York County, Alfred, Maine);

Fleury vs. Cartier International (U. S. District Court, San Francisco);

Eric Seiken vs. Pearle Vision (Superior Court for San Diego County, San Diego);

Jason White, et al., vs. National Collegiate Athletic Administration (U. S. District Court, Los Angeles);

In Re Static Random Access Memory (SRAM) Antitrust Litigation (U. S. District Court, San Francisco); and

Bernard Parish, et al., vs. National Football League Players Association (U. S. District Court, San Francisco).

I also was the co-author of an *amicus* submission that was filed within the last five years to the Federal Trade Commission on the FTC's strategic plan.

ASSIGNMENT

Attorneys for the plaintiffs have asked me to determine the economic evidence that would be used to analyze whether the defendant harmed competition by tying its portable digital music player to online music sales through its iTunes Music Store (iTMS)[1] and by maintaining and extending its market power in portable digital players, online music recordings, and online video recordings, and whether this evidence involves the use of facts and methods that are predominantly common to all members of the alleged class. Plaintiffs' attorneys also have asked me to determine whether the methods that would be used to determine the damages to each class member would be predominantly common to all class members. In addressing these questions, I focus on the methods an economist would use in assessing the validity of the plaintiffs' allegations and the methods plaintiffs could use to calculate damages. For my work on this matter, I am being compensated at the rate of $700 per hour.

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[1] In September 2006, Apple renamed iTMS the iTunes Store, which reflected the video capabilities of new iPods and expanded video content at iTMS. The last Apple press release that refers to iTMS is "Linkin Park Catalog, Exclusive Bonus Tracks & Digital Booklets Now Available on the iTunes Music Store," August 29, 2006. The first mentions of iTunes Store are in "Apple Announces iTunes 7 with Amazing New Features" and "Apple Introduces the New iPod," September 12, 2006. But after Apple introduced the iPod touch and the iPhone, both of which can access the Internet, Apple named the site where these devices could obtain downloads the iTunes WiFi Music Store

To carry out my assignment, I have reviewed several court submissions and decisions,[2] including the *Consolidated Complaint*[3] (hereafter *Complaint*), *Defendant Apple Inc.'s Answer and Defenses to Plaintiffs' Consolidated Complaint, Defendant's Notice of Motion and Motion to Dismiss Antitrust Claims, Plaintiff's Memorandum in Opposition to Defendant's Motion to Dismiss Antitrust Claims, Order Denying Defendant's Motion to Dismiss*, and *Defendant's Responses to Plaintiffs' First Set of Interrogatories Directed at Apple Computer, Inc.* I also have read documents pertaining to the financial information produced by defendant, and articles in the trade press and reports by financial analysts about the music industry, digital players, digital downloads

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("Apple Unveils the iTunes WiFi Music Store," September 5, 2007). To avoid confusion, I consistently refer to Apple's digital download business as iTMS.

[2] Some of these documents were filed in *Melanie Tucker v. Apple Computer, Inc.*

[3] *Consolidated Complaint for Violations of Sherman Antitrust Act, Clayton Act, Cartwright Act, California Unfair Competition Law, Consumer Legal Remedies Act, and California Common Law of Monopolization*, filed April 19, 2007.

of audio and video entertainment, and the financial performance of Apple, Inc., and its products. These documents are cited in this report. I also have relied on four decades of experience in studying the entertainment and information technology industries, and digital distribution of audio and video entertainment in particular.

Background Information

To clarify my assignment, I describe the elements of the *Complaint* that would be part of an economic analysis of liability and damages in this matter. Plaintiffs allege that the defendant tied the sale of audio and video files by iTMS to the sale of iPod portable digital media players. The nature of the alleged tie is that a consumer who wanted to purchase audio and video recordings from iTMS for use on a portable digital media player also was required to purchase an iPod. The alleged anticompetitive effect of tying is that the defendant used its alleged market power in legal sales of permanent downloads of audio files to reduce competition in the market for portable digital media players.

Plaintiffs also allege that the defendant attempted to and succeeded in acquiring or maintaining market power in the relevant markets for portable digital media players, digital audio files, and digital video files by engaging in anticompetitive acts that harmed consumers who bought iPods and/or downloads of digital audio and/or video recordings from iTMS. The plaintiffs further allege that consumers of iPods suffered monetary damage in buying iPods as a result of the defendant's alleged anticompetitive acts.

I understand that the plaintiffs are now focusing their complaint on a single class, which is all direct purchasers of iPods except government entities and Apple employees. The class includes consumers who bought iPods directly from the defendant and intermediaries who bought iPods from the defendant for resale.

The alleged anticompetitive acts in this matter pertain to Apple's proprietary digital rights management format (FairPlay). Several formats for unprotected digital files are used by digital media software, online download stores, and portable digital players. For audio, MP3 and AAC (Advanced Audio Coding) are industry standards that can be played on most portable digital media players. The most important proprietary audio formats are WMA (Windows Media Audio), which is used by Microsoft, and RealAudio, which is used by RealNetworks. Both are licensed to others, and can be read by many portable digital media players. Although the iPod is not compatible with RealAudio and WMA, it can play unprotected audio recordings in the MP3 and AAC formats.[4]

For video files, the Motion Picture Experts Group (MPEG) has developed several formats that are industry standards. Currently the most widely used are versions of MPEG-2 and MPEG-4 (including H.264). Two other common proprietary formats that are widely licensed are WMV (Windows Media Video) and RealVideo.

Initially the entertainment industry did not allow online distribution of unprotected audio and video files, insisting that Digital Rights Management (DRM) systems be used to encode recordings that were distributed over the Internet and to control the use of their products once they were sold, such as by limiting the number of times a recording could be played or the number of devices on which a recording could be stored. The Microsoft and RealNetworks audio and video formats are available in a protected mode, and available for licensing to manufacturers of portable digital media players and online download stores. Microsoft also has versions of its protected WMA and WMV formats that it does not license and that can not be used with any portable digital media player other than the Microsoft Zune. Apple's protected formats combine either AAC or MPEG-4 and FairPlay, the defendant's proprietary encryption system Except for a period before Apple entered the mobile telephone business when it allowed Motorola to manufacture a smart phone that included the features of an iPod and that could access iTMS,[5] FairPlay has not been licensed to others.

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[4] For more details about which audio formats are compatible with an iPod, see Apple's web site: http://support.apple.com/kb/HT1334. Video compatibility is available by model. For the iPod touch, see http://www.apple.com/ipodtouch/specs.html.

The plaintiffs allege that the following acts were anticompetitive. First, iPods are the only portable digital players that can play files that are encoded in the defendant's DRM-protected format. As a result, consumers who want to download files from iTMS to a portable digital media player must buy an iPod. Second, when Real Networks offered its Harmony software to enable its RealPlayer media player software and portable digital media players other than iPod to play files in the FairPlay format, the defendant developed new software to block that use and thereby to prevent customers that used Harmony from buying downloads from iTMS. Third, the microprocessors that are used in iPods can read WMA files, but iTunes software, which must be used to load and catalog files on an iPod, prevents consumers from making use of this capability. Fourth, the defendant refused to acquire a license to the protected WMA format that was used by other online vendors of legal downloads and refused to license FairPlay to enable competing portable digital media players to play files downloaded from iTMS.

These alleged anticompetitive acts continue to the present for recordings in a protected format. Hence, the class period runs from the launch of iTMS to the present.

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[5] Matthew Hicks, "Motorola Previews iTunes Phone," January 7, 2005, *eWeek.com*.

SUMMARY AND CONCLUSIONS

This section summarizes the results of my analysis. I conclude that the economic aspects of plaintiffs' allegations with regard to liability and damages, if true, would be proved using evidence and analysis that is predominantly common to all class members. Subsequent sections explain the basis for these conclusions.

Liability

An economic analysis of liability issues in rule of reason antitrust litigation normally deals with the following issues: market definition, market power, sources of market power, anticompetitive effects, and reasonable business justifications. In a *per se* tying case, the analysis of market definition, market power and sources of market power deals only with the tying product (DRM-protected downloads sold by iTMS). The economic analysis of rule-of-reason allegations includes all issues in all three alleged markets (online music, online video, and portable music players).

Market Definition

Market definition begins with a "reference product" (a product that is a subject of the complaint) and identifies other products, if any, that are close substitutes for the reference products. As pleaded in the *Complaint,* the reference products are iPods, digital music recordings sold by iTMS, and video recordings sold by iTMS. The allegations in the *Complaint* also involve iTunes, which is the defendant's media player software that consumers can download to their personal computers. iTunes, among other things, allows personal computers to store, catalog and play digital recordings that have been "ripped" (copied) from compact discs (CDs) and in some but not all formats that have been downloaded from the Internet.[6] iTunes also can be used for loading and cataloguing files on an iPod.

Market definition analysis identifies plausible substitutes for each reference product, based on technical descriptions, functional uses, and informed opinions among buyers, sellers and industry observers concerning which products are substitutes for the reference products. When feasible, economists also undertake statistical analysis of the effect of the price of one product on the sales of another, and on the correlation of prices among products that plausibly are close substitutes.

All of the reference products and their plausible close substitutes are mass-produced products that are sold to consumers at posted prices (for iTunes and other brands of media player software, the price is zero), including through websites that offer the same products on the same terms to all U. S. consumers. For such products, the information that is necessary to undertake a market definition analysis includes prices, sales, descriptions of technical features and functional uses of products, and perceptions of informed buyers, sellers and industry observers about which products substitute for the reference product. All of this information is identical for every consumer, and so proof of market definition is common to all class members.

Market Power

Indicators of market power in antitrust economics include excess profits, high operating margins, the inability of competitors to capture market share or otherwise substantially to reduce the profitability of the reference product, and high market concentration in the presence of barriers to entry.

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[6] Although iTunes can not rip video files from commercial digital video discs (DVDs), it can store and access video files on blank DVDs.

In economics, common direct measures of market power are the ratio of operating profits to operating costs and the ratio of the difference between price and average variable cost to the price (the Lerner Index). The defendant has produced examples of operating revenues and operating cost, and Apple's audited financial reports to the Securities and Exchange Commission contain this information by line of business for the entire class period up to the first quarter of 2008 (the second quarter of the defendant's fiscal year). These data measure aggregate market performance, so using them to prove market power is common to all class members.

To prove market power using market concentration requires data about the market shares of the significant sellers in each relevant market during the class period (April 2003 to the present). In antitrust economics, standard measures of market concentration are the market share of the largest firm, the combined market shares of the four largest firms, and the Herfindahl-Hirschman Index (HHI). The HHI is the sum of the squares of the market shares of all sellers in the market. Market share data are regularly collected by several consulting firms, and are widely reported in the trade press. Because these data pertain to market-level sales, proof of high concentration is common to all class members.

Barriers to entry include high fixed costs (a large minimum efficient scale for production facilities or substantial research, development and product design effort before a product can be manufactured), intellectual property rights, and impediments for buyers to change vendors (the lock-in effect, whereby consumers must incur significant costs to switch among sellers, and bundling, whereby products are sold together or are technically incompatible across brands, thereby forcing competitors to offer products in all relevant markets in order to compete in any single relevant market). All of these barriers to entry apply to mass-produced products or sales within a market, so that proof of barriers to entry is common to all class members.

Sources of Market Power

An economic analysis of sources of market power seeks to determine whether market power arises from offering a better product or engaging in anticompetitive acts. Economic analysis can ascertain whether the alleged acts enhanced or preserved the defendant's market power and, if so, whether these acts were anticompetitive or reflected the necessary implementation of superior foresight and efficiency.

Because tying is presumptively anticompetitive, an economic analysis of tying in this matter would focus on whether Apple's market power in portable digital players increased significantly after the introduction of iTMS and associated changes in iTunes to enable permanent DRM-protected downloads from iTMS. The evidence that an economist would use to prove that tying increased the defendant's market power in portable digital players includes evidence that competing digital players could not play DRM-protected files downloaded from iTMS and data on profit margins and/or market shares that were used to prove market power in iPods. This information would be collected for the period between the introduction of iPods in 2001 and the launch of iTMS in 2003 to distinguish between functional features and the effect of the introduction of iTunes on the market share of iPods. All of this evidence is common to all class members.

The rule-of-reason allegations are based on incompatibility between competitive portable digital players and iTMS and between competitive online music stores and iPods. To assess whether creating technical incompatibility is anticompetitive, economists examine whether technical incompatibility is a reasonably necessary by-product of the use of a technology that provides qualitative benefits to consumers, which hinges on whether the performance of the products was enhanced by the acts that created or maintained incompatibility. Also relevant to this economic analysis is whether incompatibility is costly to create and to maintain. These costs include the direct cost of making a product incompatible with another and the indirect cost of lost sales because users of incompatible products can not buy complementary products from the defendant. For example, the refusal to license FairPlay to competitors plausibly was costly to the defendant because it sacrificed potential profits that could have been earned from licensing the product and from selling downloads from iTMS to consumers who owned other portable digital players.

Plaintiffs allege that technical incompatibility between the defendant's products and its competitors created 'lock-in," whereby consumers face significant transition costs if they switch vendors in a relevant market. Lock-in increases the market power of a vendor over its customers, but it also makes the vendor a less effective competitor for the customers of other vendors in each of the relevant markets. In so doing, lock-in reduces competition for all vendors in the market. Costly creation of lock-in with no accompanying performance benefit for consumers is anticompetitive because it imposes costs on both society and the firm that pursues it while providing no offsetting benefits to consumers.

Proof that technical incompatibility is anticompetitive involves evidence about product performance, direct costs, and indirect costs in the form of foregone market opportunities. The same evidence would apply equally to all customers and so is common to all class members.

Harm to Competition

Harm to competition refers to the ways in which consumers were harmed by an anticompetitive act. One such harm is elevated prices to all consumers for the reference product, but this harm is also part of damages and so is examined in the development of a method to calculate damages. Anticompetitive acts also harm consumers in ways that normally are not included in damages. For example, intermediaries who resold iPods are likely to pass on their wholesale overcharge to their customers. Higher prices also reduce the quantity of products sold and thereby cause "dead-weight loss" – the loss of welfare arising from the lost sales that would have been made if prices were lower. In addition, competitors in the relevant market for portable digital players may charge higher prices because the anticompetitive acts reduced competition against their products, causing their consumers to pay more than they otherwise would have paid.

Technical incompatibility and lock-in harm competition by reducing the choices available to consumers. Consumers can not shop for the best deal in each relevant market and can not switch from one product without bearing the additional costs of switching vendors for other products.

Another harm to competition arises from the effect of lock-in on technological progress. Lock-in reduces a competitor's prospective sales from product innovation in only one relevant market, and hence the incentive to innovate. Thus, if the plaintiffs' allegations are true, technological innovation will be slower in all relevant markets than if competition were more intense.

The evidence that is necessary to establish these harms to competition applies to product features and market outcomes (prices, sales, and entry and exit by competitors). Examples of such information are consumer surveys about purchases of products in the relevant markets, informed opinions by industry participants and the trade press about product quality and the adoption of new technologies by vendors, data about costs, prices and quality of competitive products, and histories of competitive products. All of this information is common to all class members.

Business Justifications

A business justification of an anticompetitive act is a benefit to consumers arising from an act that also had the effect of reducing competition. An act that reduces competition can be reasonable if it provides consumer benefits that can not by obtained by any other reasonable, less anticompetitive means.

The defendant's response to the *Complaint* and *Motion to Dismiss* make general references to possible business justifications, but at this point the defendant has not yet offered sufficiently detailed justifications to make an assessment of them feasible. Hence, conclusions about how these justifications would be proved or refuted are premature. Here I focus on the evidence that would be used to analyze business justifications that plausibly might be offered in this matter.

For matters involving tying, bundling and incompatibility of complementary products, some commonly alleged business justifications are that the alleged acts improved quality through product integration, allowed consumers to hold a single vendor accountable for the performance of complementary products, and were necessary to protect the vendor's intellectual property. Economic analysis can assist in resolving these issues, and does so by analyzing the technical characteristics and performance of products in the relevant markets. Most competitors in one of the markets at issue in this litigation do not sell products in all relevant markets, and only Apple and Microsoft sell products in each relevant market that are technically incompatible with the products of competitors. An economic analysis of business justifications would address whether the opportunity to deal with multiple vendors has harmed consumers of these products or has led to greater infringement of intellectual property rights. The focus of this analysis is products, markets and systems of complementary products, and so is common to all class members.

Damages

In antitrust economics, damages are calculated by comparing actual prices for the reference product with "competitive benchmark" prices that would have been charged in the "but-for" world in which the alleged anticompetitive acts had not occurred. The competitive benchmark is not necessarily a highly competitive market, but a market that reasonably reflects the extent of competition that would have prevailed in the relevant market had the anticompetitive acts not occurred.

In this matter, the class includes both end-users and intermediaries who bought iPods from the defendant. These two types of customers paid different prices: retail prices to the online or traditional retail Apple Store versus wholesale prices to Apple's wholesale distribution division. Consequently, the method for calculating damages should take into account whether the product is sold at retail or wholesale. A damages method can account for differences between these channels. Damage calculations will be based in part on the defendant's wholesale transactions prices as well as the widely publicized retail prices of models of iPods. For each channel, damages can be estimated from a formula that is derived from an econometric model that explains the defendant's prices over time for each model of iPod as a function of, among other things, the extent of competition in the market.

Another factor to consider in developing a method for calculating damages is technological progress. Damages may vary during the class period due to technological change in iPods and their components. Technology is taken into account by including technical features and component costs into the econometric model of transactions prices.

Economists use three basic approaches to estimating competitive benchmark prices: "before-after," "yardstick," and "mark-up." The before-after method compares prices during periods when the anticompetitive acts affected competition with periods when the acts had no effect. The yardstick method compares prices for the reference product with prices of other products that have similar costs and functions but that are sold in more competitive markets. The mark-up method bases damages on actual mark-ups versus mark-ups that would be expected in a more competitive market.

Each of these methods produces a formula for damages that is based on data about prices, product characteristics, costs, and conditions in the market. All of these methods can be implemented in this case. Each method would involve data and analysis that would be predominantly common to all class members.

The remainder of this report explains the basis for these conclusions.

LIABILITY

The alleged anticompetitive acts in this case include a *per se* violation (tying) and rule of reason violations (acquiring and maintaining monopoly power). The role of economic analysis in the liability phase of rule-of-reason antitrust litigation is to address several related issues: (1) market definition, (2) market power, (3) sources of market power, (4) harm to competition, and (5) business justifications. Although *per se* antitrust allegations normally do not require proving these issues, I understand that liability in a tying case does require analysis of market definition and market power for the tying product and harm to competition for the tied product, and may involve business justifications in at least one of these markets. I will summarize here how these issues would be addressed in this case.

Market Definition

The purpose of relevant market analysis is to identify products that are close substitutes. Products are substitutes on the demand side if buyers would switch from one product to another in response to a small reduction in the relative price of the latter. Products are substitutes on the supply side if sellers would switch production from one product to another in response to a small increase in the relative price of the latter.

In antitrust economics, a relevant market consists of a reference product (the product that is the subject of the complaint) and close substitutes for that product that could be profitably monopolized. The task of market definition analysis is to identify the closest substitutes for a reference product that significantly limit the market power of its supplier. To be close substitutes, products must be sufficiently similar that consumers regard them as substitutes for performing the same functions, and must be conveniently available to consumers in the same geographic area. The relevant market consists of the smallest number of products that, if sold by a single supplier, would be able to impose a small but significant non-transitory increase in price (SSNIP) in comparison with the prices that are charged when each product is sold separately.[7]

The *Complaint* alleges three relevant markets: online music sales, online video sales, and portable digital music players. The geographic area for these markets is the United States. The reference products are iPods, digital music downloads that are sold by iTMS, and digital video downloads that are sold by iTMS. A fourth product, the iTunes digital media player, plays an important role in the alleged anticompetitive acts by the defendant but plausibly is not part of any of these relevant markets. iTunes is a computer program that enables a consumer to store, catalog and access digital files on personal computers and iPods.

The class includes both consumers and intermediaries who bought iPods. Typically wholesale and retail sales occur in different relevant markets because, theoretically, one can be profitably monopolized without monopolizing the other. Thus, Apple may have substantial market power as the dominant firm in portable digital media players, but face intense competition from other retailers in selling iPods to consumers. One can imagine circumstances in which a retailer had substantial market power in the retail market for portable digital media players that, in turn, were produced by many competing manufacturers, none of which enjoyed market power.

In this litigation, the alleged anticompetitive acts involve technical features of iPods that reduce the substitutability of other products for those of the defendant from the perspective of final consumers. Whereas the Apple Store can not substitute other brands of portable digital media players for the iPod, final consumers and other retail outlets can engage in such substitution. The possibility for substitution among final consumers provides the incentive for other retailers to engage in such substitution in the wholesale market. Hence, the appropriate focus for an analysis of the relevant market for portable digital media players for both types of class members is to identify close substitutes for iPods among final consumers, regardless of whether the product was sold at retail by the defendant or at wholesale by the defendant to another retailer.

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[7] *Merger Guidelines*, U. S. Department of Justice and Federal Trade Commission, 1994.

Economists use several methods to identify a relevant market. In some cases, economists estimate the cross-elasticity of demand (that is, how the sales of one product are affected by the price of other products) between the reference product and each other product that might be regarded as close substitutes. Data limitations preclude econometric estimation of cross-elasticity of demand in most cases.

If reliable estimation of cross-elasticity of demand is not feasible, economists look for indirect evidence that products are close substitutes: similarity of components and functional uses, statements outside the context of litigation by executives and industry analysts about their beliefs about which products are close competitors, surveys of buyers about which products they considered before buying a product that is a candidate to be included in a relevant market,[8] and the correlation of prices among products that are candidates for inclusion in the relevant market.[9]

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[8] For a discussion of the use of customer surveys in market definition, see Graeme Reynolds and Chris Walters, "The Use of Customer Surveys for Market Definmition and the Competitive Assessment of Horizontal Mergers," *Journal of Competition Law and Economics*, Vol. 4, No. 2 (June 2008), pp. 411-31.

[9] George J. Stigler and Robert A. Sherwin, "The Extent of the Market," *Journal of Law*

On rare occasions products are sold only to a single buyer. Examples are unique construction projects such as home renovations, specialized semiconductor products that are custom designed for a single electronic device, or circumstances in which a monopoly or a cartel engages in price discrimination against each buyer separately such as the bid-rigging conspiracy for off-shore oil platforms. In these circumstances, the information required to establish market definition (as well as other liability allegations and damages) may be individual, rather than common to the class. More commonly a large group of consumers makes purchases from the same or a mostly overlapping group of sellers, each of which offers similar products at posted prices. In this circumstance, the information that is used to define relevant markets is common to all consumers.

The plaintiffs have alleged three relevant markets: "Online Music," "Online Video," and "Digital Music Player."[10] The reference products for these markets are, respectively, digital audio recordings that are sold by iTMS, digital video recordings that are sold by iTMS, and iPods. The alleged geographic market for each product is the United States. Thus, market definition consists of identifying all products that are close substitutes for each of these three reference products among buyers in the United States.

The "Online Music" market is described in the *Complaint* as online music stores that enable consumers legally to purchase a digital music file that "lasts indefinitely." This product market is alleged to be distinct from the market for a physical recording that is purchased from either a traditional bricks-and-mortar retail outlet or an online retailer that ships physical products to the consumer. From the descriptions in paragraphs 3 and

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and Economics, Vol. 28, No. 3 (October 1985), pp. 555-85.

[10] *Complaint*, pp. 1-2.

4 of the *Complaint*, I infer that the alleged relevant market pertains to permanent downloads, and excludes streaming audio services and services that sell temporary downloads that self-destruct after a predetermined time period or when the customer stops paying a monthly subscription fee.

I also infer that the crucial characteristic of a digital music download that is sold online is that it is an audio recording, not that it contains music. Although the conventional term that is used in the industry and trade press to describe audio recordings, whether physical copies or digital downloads, is "music," some audio recordings contain no music, such as recordings of comedy routines, programs from the "golden age" of radio, political speeches, and readings of books and plays. For example, a permanent digital download of "I Can Hear It Now," the news/history recording based on old radio programs, starring Walter Cronkite and produced by Fred Friendly, is listed for sale under "music" on both Amazon.com and iTMS, as are comedy recordings by Bob Newhart. Likewise, both "music" sites offer "best sellers" on audiobooks. Thus, I conclude that the actual relevant market that is alleged in this complaint is the market for legal permanent downloads of all types of audio recordings.

The "Online Video" market pertains to digital video files, such as music videos, motion pictures, and television programs. This product market is alleged to be distinct from the product market for physical copies of video recordings, such as video tapes and digital video discs (DVDs). The *Complaint* describes this market as similar to the market for audio files, from which I infer that this market also excludes sales of streaming and temporary downloads.

The "Digital Music Player" market is described in the *Complaint* as containing battery-powered portable devices that can play digital music files, as distinct from portable CD players. For the same reasons given in the discussion of the market for online music, I infer that here the plaintiffs again have adopted the conventional use of the term "music," and that the key characteristic of these products is the ability to store and play digital audio recordings of all types, not just music.

During the class period, the technology of portable digital players has evolved. In 2005, Apple introduced an iPod that could play digital video files and simultaneously began to sell video downloads through iTMS.[11] In 2007 Apple introduced the iPod touch, which can access the Internet for downloads.[12] Digital media players also are bundled with "smart phones," like Apple's iPhone, launched in July 2007.[13] A smart phone combines the features of a mobile telephone and a personal computer. If a smart phone has sufficient memory, it can be used to store and play digital audio and video files, and so can be a substitute for a digital media player.[14]

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[11] "Apple Unveils the New iPod" and "Apple Announces iTunes 6 with 2,000 Music Videos, Pixar Short Films & Hit Shows," Apple Press Releases, October 12, 2005. See also http://www.apple-history.com/?page=gallery&model=ipod_video.

[12] "Apple Unveils the iTunes WiFi Music Store" and "Apple Unveils iPod Touch," Apple Press Releases, September 5, 2007. Despite the growing capability of iPods to play video files and access the Internet, Apple continued to call these devices "the world's most popular family of digital music players" in the latter press release.

[13] "iPhone Premiers This Friday Night at Apple Retail Stores," Apple Press release, June 28, 2007.

[14] Financial analysts have concluded that iPhones and iPods are substitutes. See, for

All portable devices that store and play digital video files as well as digital music files are plausible substitutes for portable digital music players.[15] Thus, the appropriate description of this product market since roughly the fall of 2005 is likely to be the (portable) "Digital Media Player" market and to include products that bundle a portable media player with a mobile telephone and/or the capability to access the Internet.[16]

A fourth product, digital media players, must be incorporated into an economic analysis of the issues in this litigation.[17] A digital media player is a computer program

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example, "AAPL: The Reason for the iPhone's Reported Woes Is Closer than You Think: It's the iPod touch," Needham & Compnay, January 28, 2008, and "Apple's Negative Guidance Tone at the FQ1 Call Means a Lower Valuation of Multiple: Hold," Kintisheff Research, January 23, 2008. The former focuses on iPods cannibalizing the sale of iPhones, and the latter focuses on iPhones cannibalizing iPod sales.

[15] Because the price of a smart phone is roughly equal to the sum of the prices of a digital media player and an ordinary mobile telephone, a smart phone plausibly is a close substitute for the separate purchase of a portable digital audio player and a mobile telephone. Mobile telephone penetration in the United States is over 240 million, so that a very large fraction of consumers who want a portable digital audio player also are likely to want a mobile telephone. Thus, for the vast majority of consumers, smart phones are likely to be a reasonable alternative to a portable digital audio player.

[16] An example of an analyst's report that reached this conclusion is Charlie Wolf, "AAPL: Its MacWorld and We're Just Living in It, Upgrading Apple from Buy to Strong Buy," Needham and Company, January 23, 2008.

[17] A digital media player should not be confused with the similarly named portable

that allows a consumer to transfer, store, catalog and play audio and video files on a personal computer, to make physical copies of those files if permitted by the DRM system, and to transfer and catalog these files on a portable digital media player. iTunes is the only digital media player that can download a recording from iTMS and that can play a recording that uses the FairPlay format. Recordings in the FairPlay format can not be transferred to and played on a portable digital media player other than an iPod without using another program[18] and, in almost all cases, a CD burner or other electronic equipment, such as the DuroSport iTunes Compatibility Kit.[19] Likewise, iTunes can not convert WMA and WMV files into a format that can be played by an iPod. Protected WMA and WMV are the most commonly used formats by other online download vendors for audio and video recordings that must be sold in a DRM-protected format. Thus, iTunes plays an essential role in maintaining technical incompatibility between the defendant's products and competing products in the relevant markets.

To define the relevant markets in which portable digital media players, online audio recordings, and online video recordings are sold involves collecting information about prices, product characteristics, and informed beliefs among buyers, sellers and

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digital media player. The latter is a physical electronic device that plays digital files, while the former is a computer program that, among other things, loads files to the latter.

[18] Some hackers have offered programs for breaking FairPlay's encryption and converting a protected file from iTMS to an unprotected AAC or MP3 file, but these programs are not wholly successful and may be illegal.

[19] See http://www.prismdurosport.com/news/itunes-compatibility-kit-allows-ipod-users-to-switch-to-prism-durosport.html.

industry observers about the closest substitutes for each reference product will be collected for the reference products and plausible close substitutes.

For iPods, the most obvious substitutes are other portable digital media players.[20] Amazon.com lists the following brands among its "best sellers" in portable digital media players: Archos, Coby, Cowon, Creative Zen, Ibiza, iPods, iriver, Latte, Meizu, Microsoft Zune, Philips, SanDisk Sansa, Samsung, Sony and Toshiba.[21]

For audio and video downloads from iTMS, the most plausible substitutes are downloads from other online sites that offer a large catalog of audio and video files from the major distribution companies. Other Internet sites that sell legal permanent downloads of major theatrical movies, television programs from the most popular television networks, and audio recordings from the four major audio recording distribution firms include Amazon.com, BuyMusic, Napster, Rhapsody, WalMart and Zune. Other online sellers of permanent downloads, such as eMusic and Ruckus, should be considered in this analysis, but they are not as close substitutes for iTMS because they sell downloads only from independent distributors or artists who have no distributor.

In addition, other types of media player devices and recordings also will be analyzed to assess whether they are close enough substitutes for the defendant's products to be included in the same relevant market. These include retail outlets for physical audio recordings (e.g., CDs) and video recordings (e.g., video tapes and DVDs), portable players of CDs and DVDs, online sales of temporary or streaming digital downloads, and semi-portable audio and video players, such as automobile media players.

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[20] For an example of detailed comparisons of the iPod and its leading substitutes, see "Portable Digital Players: iPods Rule but Consider Other Brands," *Consumer Reports*, November 2006, at http://www.consumerreports.org/cro/electronics-computers/audio-video/audio/ipods-mp3-players/mp3-players-11-06/overview/1106_mp3_ov_1.htm.

[21] See http://www.amazon.com/gp/bestsellers/electronics/16009311/ref=pd_ts_pg_1?ie =UTF8&pg=1.

All candidates for inclusion in these three relevant markets are mass-produced products that are sold at posted prices through traditional and online retail outlets. Trade associations such as the Recording Industry Association of America (RIAA) and several trade research organizations publish data and analyses that contain information about prices and sales,[22] and trade publications and reports by securities analysts contain information about the extent of competition between the defendant and other entities for each reference product.[23] In addition, based on my experience in other litigation involving firms in the electronic equipment and recording industries, I expect that a great deal of relevant information for undertaking market definition analysis is possessed in the defendant's corporate records and so will be produced in discovery. Identically the same information would be required to prove the relevant market if each member of the class were to make separate antitrust claims against the defendant. Thus, proof of the relevant market would be common to all class members.

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[22] For example, the NPD Group publishes reports about developments in digital media products and issues press releases the reveal some of the information in these reports. See, for example, "The NPD Group: Amazon MP2 Music Download Store Offers a New Hope for Digital Music Growth," NPD Press Release, April 15, 2008.

[23] For example, Antone Gonsalves, "Microsoft Gets More Social with Zune Update," *Information Week*, May 6, 2008.

An issue that may arise in this litigation is whether all or some of Apple's digital play products should be regarded as part of one market for an integrated "system" of complementary products, rather than separate product markets. The textbook example of a system market is right shoes and left shoes. Whether complementary products are part of a single relevant system market hinges on whether each component has independent demand. Demand is independent if at least some consumers make distinct decisions about whether to acquire a component of the system. Demand can be independent because some consumers do not want all components or prefer to acquire different components from different vendors. In the case of shoes, demand for right and left shoes is not independent because virtually no one wants a shoe for one foot or shoes for each foot that have different styles, so that a pair of shoes is priced and sold together.

Economic analysis of market definition explores whether nearly all consumers always acquire all three types of products, and whether almost all consumers patronize the same vendor for all three types of products. If a large fraction of consumers do purchase all products from the same vendor, economic analysis can determine whether the cause is tying or bundling, rather than a true preference for an integrated system. If demand is not virtually completely overlapping, then the products are sold in separate relevant markets. If a significant number of consumers do not buy all products from the same vendor, each vendor will price each component independently, and each component will constitute a separate relevant market. Proof of independence of demand is a condition of the markets for these products, and so proof of separate demand is common to all class members.

A plausible outcome of an economic analysis of market definition is that digital media players (like iTunes) are a distinct relevant product market. The reason is that these products have many other uses, such as accessing media content on many other types of web sites. Even when used to play audio and video entertainment, iTunes can be used only to transfer unprotected digital files from physical recordings to a personal computer, to catalog and play these recordings on a personal computer, and even to make physical copies of these recordings. If iTunes and other digital medial players[24] are used by some consumers exclusively for purposes other than to buy permanent downloads of audio and video recordings and/or to play recordings on iPods, then these products are likely to constitute a separate relevant product market.

Market Power

Market power is the ability to control prices or exclude competitors. Economists use both direct and indirect measures of market power.

Direct measures of market power include the profits and mark-ups of price over average variable cost, the own-price elasticity of demand (the responsiveness of sales to price) for the reference product, and incidents in which a competitor was driven from the market or abandoned an attempt to enter the market as a direct result of the defendant's actions. A firm with market power will have profits and price-cost margins that exceed an appropriate competitive benchmark, will have an own-price elasticity of demand that is not highly responsive to price changes for prices near competitive levels, and will be able successfully to defend its sales and excess profits against attempts by competitors to capture a larger market share.

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[24] Whereas numerous digital media players are available, the leaders are Apple (iTunes and Quick Time), Microsoft (Windows Media Player) and RealNetworks (RealPlayer). See "iTunes Player Hits a High Note, Passes RealPlayer – U. S. Broadband Penetration Increases to 86.79% among Active Internet Users – January 2008 Bandwidth Report," WebSiteOptimization.com, January 2008. All of these products are given away for free.

The data that are necessary to analyze profits and mark-ups are revenues and costs on a product-line basis. The defendant has produced examples of line-of-business financial accounts, along with explanations of how costs are allocated among product lines. In addition, the defendant's financial reports to the Securities and Exchange Commission contain revenues and costs by product line. For example, in Apple's financial report for the second quarter of fiscal 2008 (Form 10-Q, submitted in May of 2008), one of the product lines reported is "iPod," another is "iPhone and related products," and another is "Other music related products and services," which is mostly iTMS sales. Thus, the defendant keeps records in a manner that are satisfactory to estimate profit margins for the reference products, and the analysis of this information would be common to all class members.

In addition, financial analysts regularly provide interpretations of data about Apple's sales, costs and profits. For example, one financial analyst reports that the price difference between two models of iPods that differ only by the amount of memory that they contain is more than double the difference in cost.[25] This price difference could not be sustained in a competitive market, and so is an example of market power. Likewise, an academic analysis of the relationship between price and component costs for "high-end" consumer electronics finds that Apple earns higher margins over its component costs on iPods than do other manufactures of innovative consumer electronics products.[26]

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[25] "The Mix Get Richer: New iPod touch & iPhone Capacities," Credit Suisse, February 5, 2008.

The own-price elasticity of demand is estimated from data about prices and quantities of sales. The defendant produces a small number of models of iPods (and, more recently, iPhones), each of which is sold at a posted price either in traditional retail outlets or through the company's web site. Almost all audio recordings are sold at one of a few posted prices. Most likely, prices and associated sales volumes are maintained by the defendant, but even if they are not, various trade organizations and publications regularly report these numbers. In either case, the process of estimating the own-price elasticity of demand for each reference product would be common for all class members.

The evidence pertaining to the exclusion of competitors involves analyzing the success of attempts by competitors to offer products that directly compete with the reference product. Examples are the entry of other online sellers of digital downloads and of new portable digital audio players, such as the introduction of portable digital media players by manufacturers that used Harmony to play recordings that were stored in the defendant's DRM format. Another example is the LG Voyager smart phone.

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[26] Jason Dedrick, Kenneth L. Kraemer and Greg Linden, "Who Profits from Innovation in Global Value Chains? A Study of the iPod and Notebook PCs," Personal Computing Industry Center, University of California, Irvine, May 2008. The authors state that a "key reason … is that Apple's control of the core software, proprietary standards and complementary infrastructure of the iPod enables it to retain greater profits, whereas a large share of the PC industry profits are siphoned off by Microsoft and Intel, whose ownership of valuable standards allows them to charge a considerable price premium."

Both trade publications and the web sites of competitors contain information about products that have been introduced into the relevant market since the introduction of iPods and iTMS, and several organizations periodically provide estimates of the market shares of these competitors. If the plaintiffs' allegations are correct, these attempts to compete will not have been successful in substantially capturing the market share and undermining the market power of the defendant. This evidence also involves market-level information, and so is common to all class members.

Indirect measures include the extent of concentration in the market and the presence of barriers to entry. In antitrust economics, market power is inferred from high concentration and barriers to entry. In the presence of barriers to entry, economists infer that a firm is likely to enjoy market power if its market share exceeds 45 percent, or if a firm is among five or fewer firms that account for all or nearly all of sales in a market. The most common measure of market concentration is the Herfindahl-Hirschman Index (HHI), which equals the sum of the squares of the market shares of the firm in the market. In the presence of barriers to entry, an HHI exceeding roughly 2000[27] is regarded as sufficient to infer that the market is not competitive.

Data about market concentration in the alleged relevant markets are available from public sources, including consulting firms, financial analysts, trade associations, and trade publications. Public sources report that the iPod is the dominant portable digital player. For several years, iPod's market share by revenue in portable digital media players has exceeded 80 percent,[28] but before iTMS was introduced, iPod's market share was under 30 percent.[29] Likewise, publicly available sources report that iTMS accounts for over 70 percent of sales of legal digital downloads.[30] Assuming that the relevant markets are correctly pleaded by the plaintiffs, these shares exceed the threshold (45 percent) that antitrust economics regards as sufficient to infer that a firm has monopoly power in the presence of barriers to entry.

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[27] A market with five firms of equal size has an HHI of 2000.

[28] Philip Elmer-DeWitt, "How to Grow the iPod as the MP3 Market Shrinks," *Fortune*,

In addition to market share information, the indirect approach also requires showing that conditions in the market are conducive to the exercise of market power.

January 20, 2008, accessed on http://apple20.blogs.fortune.cnn.com/2008/01/29/beyond-the-incredible-shrinking-ipod-market/.

[29] Joe Wilcox, "Media2Go Team Gets Creative," C/Net News.com, March 13, 2003, reporting the iPods market share at the end of 2002 was 27 percent; Rob Walker, "The Guts of a New Machine," *New York Times*, November 30, 2003, reporting that iPods market share jumped to 56 percent in the summer of 2003 after the launch of iTMS; Mark Heflinger, "Zune MP3 Market Share up to 4%, Creative Drops to 2%," *Media Wire*, May 12, 2008, reporting that iPod's market share was 71 percent in early 2008, compared to 72 percent a year earlier.

[30] "Since its inception on the MAC platform five years ago, Apple's iTunes music store has dominated the paid digital landscape. Only a few competitors have survived, however, and those that remain garner a comparatively small market share of digital music unit sales," from "The NPD Group: Amazon MP3 Music Download Store Offers a New Hope for Digital Music Growth," NPD Group Press Release, April 15, 2008. The second place download site reportedly was Amazon.com, but it had about one-tenth the share of iTMS and very little of its business had come at the expense of iTMS.

The most important of these conditions is the presence of barriers to entry. A barrier to entry is any condition that would prevent a firm from either entering a market or expanding its output in a market in which it is already present. Examples of barriers to entry are high fixed costs that require an entrant to sell a large amount of output at existing market prices in order to operate profitably and intellectual property rights that protect an incumbent with market power from competition. Anticompetitive acts also can create a barrier to entry. An example is tying or bundling. In the presence of tying or bundling, an entrant must succeed in successfully producing both products, rather than only one, in order to compete in either market.

Entry barriers are assessed in part by examining the cost structure of the firms in the industry to determine the relative size of fixed and variable costs. The higher is this ratio, the higher is the fixed-cost barrier to entry. These data are easy to obtain because all publicly traded companies must collect and report financial data in a form that separates fixed from operating costs. In addition, the nature of intellectual property in the industry also needs to be assessed. For example, a major issue in this litigation is likely to be whether Apple's digital rights management system for iTunes and iTMS and its "crippleware" (for example, the code that prevented Harmony from playing FairPlay files) was a legitimate exercise of its intellectual property rights or an anticompetitive act to exclude competitors. A threshold issue in resolving this question is whether these acts reduced the sales of competitors in the portable digital media player market and/or the online digital download markets.

In all of these examples, the proof of an entry barrier involves general information about the defendant and its competitors. Proof of the existence of barriers to entry, therefore, is common to all members of the class.

Some class members are intermediaries, and in principle the retail market for digital media players could be sufficiently concentrated that one or a few retailers could enjoy market power as sellers in the retail market and buyers in the wholesale market (monopsony power). If so, seller concentration in the wholesale market could be a misleading indicator of market power. The evidence that an economist would use to determine whether this is in fact the case involves analyzing market concentration and entry barriers among wholesale buyers. The defendant's iPod sales records will show whether one or a few wholesale buyers have a high enough market share in buying iPods to give them significant buyer power. Proof of the absence of buyer power involves the analysis of market-level data, and so is common to all class members.

Regardless of how market power is proved, exactly the same data would be collected and analyzed for each class member if each were to make the same antitrust claims separately against the defendant. Thus, proof of market power is common to all class members.

Sources of Market Power

If a firm enjoys market power, economic analysis can be used to determine whether its market power is due all or in part to anticompetitive acts. In this section, I assume that the defendant's market power in all three relevant markets has been established, and that the task of economic analysis is to determine whether this market power was created, enhanced or maintained by anticompetitive acts.

Firms may enjoy market power due to "superior foresight and efficiency," i.e., their products are cheaper and/or better because they have superior technology and/or management. For example, technological innovations that are protected by intellectual property rights or that otherwise are difficult for competitors to copy are a legitimate source of market power. Likewise, if the production technology in an industry exhibits economies of scale that are sufficiently strong that only a small number of firms can achieve the minimum efficient scale of production, firms in that industry are likely to enjoy market power and to earn excess profits. In antitrust economics, these sources of market power are not regarded as anticompetitive.

Firms also may acquire or maintain market power by anticompetitive means. In antitrust economics, an act is regarded as unambiguously anticompetitive if it increases or maintains market power, does not improve the quality or diversity of products available and so delivers no benefits to consumers, is unrelated to the legitimate protection of intellectual property rights, and requires costly action by the firm that undertakes it. An act may be anticompetitive if it provides benefits to consumers and is not costly to the firm with market power, but only if it there are no reasonable alternative means to achieve the same consumer benefits.

In this litigation, plaintiffs allege that the defendant harmed competition in portable digital players by tying the sale of digital recordings from iTMS to the sale of iPods. Plaintiffs also allege that the defendant attempted to monopolize, and acquired or maintained monopoly power, in all three relevant markets by creating unnecessary incompatibility between its digital recording products and potentially substitute products offered by others. The burden of an economic analysis of the sources of market power is to determine whether these alleged anticompetitive acts affected market power and, if so, whether these acts were anticompetitive.

Tying as an Anticompetitive Source of Market Power

Tying occurs when a consumer is forced to buy one product in order to be able to use another product for which the seller has market power. Tying normally does not involve products that are used in strict fixed proportions. Instead, the typical case is one in which consumers vary in their purchases of the tied product.

The anticompetitive effect of tying arises for two reasons. First, tying causes the market for the tied product to be no more competitive than the market for the tying product. Because tying requires that the firm has market power in the market for the tying product, tying usually gives the firm market power in the tied product as well. Second, tying increases barriers to entry in both the tied and tying product markets. The reason is that a competitor must enter both markets in order to compete in either market against the firm that engages in tying.

In this matter, in order to play digital recordings acquired from iTMS on a portable digital player, a consumer must buy an iPod because only an iPod can play recordings in the DRM-protected FairPlay format that is used by iTMS. The use of FairPlay is the mechanism that ties iPods to iTunes. Because this format is common to all DRM-protected digital recordings on iTMS, proof of its existence, the inability of competing online download stores to sell DRM-protected recordings for use on iPods, and the refusal of the defendant to license FairPlay all are characteristics of the relevant markets, and so is common to all class members.

Once the encryption allegation is established, economic evidence that is relevant to the tying claim includes showing market power in the tying products (the two types of digital recording products sold by iTunes). I understand that because tying is a *per se* antitrust violation, plaintiffs additionally need to show only that the tie harmed competition by having a "not insubstantial" effect in the market for the tied product. Economic analysis is relevant to ascertaining whether the tie caused the defendant's market share in portable digital players to be higher than otherwise would have been the case. A related piece of economic evidence is whether tying increased barriers to entry in the market for portable digital players. Higher entry barriers also can increase the long-run market power of a dominant seller.

Plaintiffs allege that RealNetworks attempted to compete against iPods by inventing a digital media player that could play digital recordings in the format that was used by iTMS on a personal computer, and in collaboration with manufacturing partners to create portable digital media players that also could play DRM-protected audio and video files from iTMS. Plaintiffs allege that RealNetworks was thwarted in this effort when the defendant changed its encryption code to defeat the compatibility of Harmony with iTMS and FairPlay. This allegation, if true, is an example of how tying creates a barrier to entry in the market for the tied product because it requires a competitor to experience recurring costs to reverse engineer an ever-changing technical incompatibility.

Another relevant piece of economic evidence is whether tying increased barriers to entry in the relevant markets for digital recordings by eliminating owners of iPods as potential customers for a new competitive source of digital recordings. In this case, success at tying allegedly causes increased sales of iPods, which in turn would create a large installed base of iPod owners who possess digital recordings obtained from iTunes. If the allegations of the plaintiff are true, then to acquire digital recordings over the Internet from a source other than iTunes for use in a portable device, these customers would need to buy another portable digital player, but they would then be unable to continue to use the recordings that they had purchased for use in their iPods. Economic analysis is useful to assess whether in fact tying iPods and iTunes created an entry barrier in the markets for digital recordings. This evidence applies to conditions in these markets, not characteristics of a consumer, and so is common to all class members.

Technical Incompatibility as an Anticompetitive Source of Market Power

The plaintiffs also allege rule-of-reason claims regarding monopolization and attempted monopolization in all relevant markets. These allegations also hinge on the strategy of the defendant in encoding audio and video files in its proprietary iTunes software. The first versions of iTunes let consumers extract, catalog and play audio compact disk (CD) recordings on a computer, to make additional copies of these CDs, and later to transfer these recordings to an iPod. Beginning in April 2003, iTunes 4.1 allowed consumers to download audio and video recordings from iTMS to a computer and permanently to transfer and access these recordings on an iPod.[31] The plaintiffs allege that iTunes software generally prevents other portable digital players from playing DRM-protected recordings that have been downloaded from iTMS and blocks iPods from being able to play DRM-protected recordings acquired from other Internet retailers. Economic analysis can be used to determine whether the defendant's iTunes encoding strategy after the introduction of the iPod and iTMS increased and/or maintained its market power in the three relevant markets. In addition, the economics of standardization can be applied to the defendant's encryption strategy to determine whether its effect in the market was anticompetitive.

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[31] Since September of 2007, the defendant has offered an iPod model that enables direct downloads from the Internet; however, these recordings are not accessible for play on the iPod until the consumer connects the iPod to a computer and allows iTunes to add the

With respect to digital recordings, iTMS was launched in April 2003 for users of Apple computers and in October 2003 for personal computers with the Windows operating system. Although several companies had sought to enter the business, including now-bankrupt Tower Records, iTMS was the first online site that was permitted legally to sell permanent downloads of a large catalog of audio recordings. Consequently, the defendant plausibly had a substantial first-in advantage. Assuming that prior analysis has established that iTMS enjoyed market power since it was established, economic analysis can be used to identify the original sources of its success and the sources of its persistence as the dominant source of legal Internet downloads of audio and video recordings. Economic analysis of the technical features and inventories of competitors to iTMS can be used to determine the extent to which the defendant's early advantages persisted, and hence whether these advantages explain the defendant's continued market power in digital downloads of recordings throughout the class period. Because this analysis is based on the economic history of digital downloads and the

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recording to the directory of recordings on the iPod.

entities that participated in the business, it is common to all class members.

In May 2007, iTMS introduced iTunes Plus, which offers recordings from EMI, some independent record labels, and some unaffiliated artists in an unprotected format. These recordings can be loaded onto some portable digital players other than iPods, although doing so requires manipulation of the files in both iTunes and another digital media player. In September 2007, several other online retailers began to sell audio recordings from all of the major distribution companies that lacked DRM protection, although iTMS still sells BMG/Sony, Warner and Universal recordings only in the FairPlay DRM-protected format. As a result, audio files purchased from other sites can be loaded, catalogued and played on an iPod, although again doing so requires the use of two digital media players.

Going forward, the creation of DRM-free downloads of audio files is likely to reduce the alleged anticompetitive effects of the prior anticompetitive acts, but if these effects are present, DRM-free audio downloads are not likely to eliminate them. Video files continue to be sold primarily in DRM-protected formats, so that the incompatibility between Apple's products and the products of its competitors remains for video files.

With respect to portable digital players, the alleged anticompetitive acts initially were not in force. Early versions of iTunes were developed for use first on Apple computers and then on other personal computers that used the Windows operating system. These versions were compatible with many portable digital players that supported MP3 and other early formats for storing digital audio files. Only with the introduction of iTMS and the version of iTunes that allows access to iTMS did the defendant create incompatibility with other portable digital media players by rejecting the

DRM-protected version of the WMA format, adopting the proprietary FairPlay format, and not licensing FairPlay for use on other digital media players, other online retailers of digital downloads, and other manufacturers of portable digital media players.

Economic analysis can ascertain whether the defendant enjoyed greater market power in portable digital players after the introduction of iTMS. Here economic analysis can use the results of the market power analysis to determine whether the defendant's market power in iPods increased significantly after the introduction of iTunes. This analysis requires extending the market power analysis backwards to the period between the introduction of iPods and the introduction of iTunes, and showing that market power in iPods increased after iTunes was launched. All of the information used in this analysis pertains to conditions in the market for portable digital players, and so is common to all class members.

To establish that the encryption strategy caused an increase in the defendant's market power in iPods requires analyzing the qualitative attributes of iPods to ascertain whether iPods offered superior features other than access to iTunes that could explain the defendant's greater market power in portable digital players during the class period. One source of such information is products reviews that compare the performance of portable digital players.[32] All of this information applies equally to all of the products in the relevant market, and so is common to all class members.

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[32] An example is "Portable Digital Players: iPods Rule, but Consider Other Brands," *Consumer Reports*, November 1, 2006, which finds that iPods are easier to use but have undesirable features, such as a short battery life, no Fm radio, and the necessity to turn on a personal computer in order to recharge the battery. The article concludes that there is little overall difference in quality between iPods and its competitors.

Economic analysis also can address the effect of the shift in policy by the recording industry whereby it licensed Apple's competitors in the online retail market for audio downloads to sell recordings in an unprotected format. This change enables iPod users to buy audio recordings from the competitors of iTMS; however, the change did not affect the incompatibility between the defendant's products and the products of their competitors with respect to video downloads because these primarily still are sold in protected formats. Thus, for purchases of video downloads, consumers who want to buy from iTMS must buy iPods.

Economic analysis also can address whether the defendant's encryption strategy is anticompetitive or an example of superior efficiency. The distribution of recordings over the Internet requires the use of some format for strong and playing the recording. Until 2007, the major distribution companies for musical recordings and movies required that digital rights management systems be implemented for all downloads of their audio and video products. Apple's FairPlay DRM format is a form of standard in that the digital file and the player must be compatible with the same format. Since 2007, EMI has permitted iTMS to sell recordings in an unprotected format, and all four major distribution companies in the audio recoding industry have allowed other online music vendors to sell recordings in an unprotected format. For the other three major distribution companies, iTMS continues to sell only encrypted recordings. Moreover, the iPod/iPhone products remain the only portable digital players that can play recordings that are downloaded from iTMS. With some effort, since 2007 unprotected MP3 files that are downloaded from online sites that compete with iTMS can be accessed by iTunes and stored, catalogued and played on iPods.

One element of the economic analysis of the allegations concerning the creation and maintenance of technical incompatibility is to examine whether the technical incompatibility was costly to the defendant. The costs associated with the technical incompatibility have two components: direct cost and opportunity cost.

The direct cost is the incremental cost of creating incompatibility. The issue here is not that the defendant had to incur costs to implement its proprietary file format, but that the defendant was forced to incur additional costs for actions that had no purpose other than to create or maintain incompatibility. For example, the analysis would identify costs associated with removing the capability of the iPod microprocessors to read competing file formats, such as DRM-protected, compressed Windows Media Audio (WMA) digital files. Another example is the cost associated with defeating the capability that of RealNetworks' Harmony to read files downloaded from iTMS while preserving FairPlay's DRM protection of these files.

Opportunity cost refers to the sacrifice of sales in one product in order to create and maintain incompatibility between its competitors and the other product. This analysis would focus on whether iTMS would have experienced greater sales had owners of competing portable digital players been able to buy digital downloads from iTMS, and whether iPod sales would have been greater had iPod owners been able to buy digital downloads from competing online vendors.

The evidence and analysis about the costs of incompatibility pertains to the experiences of the defendant. This evidence would be identical for all class members.

Plaintiffs also allege that technical incompatibility between the defendant's products and its competitors create 'lock-in." Lock-in occurs when consumers face significant transition costs if they switch vendors for one of a complementary group of products.[33] The textbook example is a computer applications program. Once a consumer has learned to use a particular application, such as a word processor or a spreadsheet, over time the consumer will develop a library of files that are repeatedly used with that application. A consumer who buys a new computer typically will buy a new version of the same application that takes advantage of the enhanced capability of the new computer. But a consumer who buys a competing version of the same applications program may face two significant extra costs. First, the consumer must learn how to use the new applications program, which takes time and may require buying instruction manuals and training. Second, the new applications program may not be able to read the old files that were created by the old applications program, thereby causing the consumer either to recreate the files in the format used by the new program or to abandon using those files. Consumers are said to be locked in to an applications program if these costs are sufficiently large that they continue to buy the same program even though an alternative has superior performance and/or lower price.

Lock-in increases the market power of a vendor over its customers. Once a consumer is locked in, a vendor can raise the price of its product as long as the price increase is less than the net cost of switching[34] to another vendor. But lock-in also makes the vendor a less effective competitor for the customers of other vendors. Thus, in the case of a software applications product, creating technical incompatibility means that consumers of competing applications programs can not switch to the vendor's product without experiencing switching costs associated with file format incompatibility.

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[33] For a discussion of lock-in, see Carl Shapiro and Hal R. Varian, *Information Rules: A Strategic Guide to the Network Economy*, Harvard Business School Press, 1999.

[34] The net cost of switching is the gross switching cost minus the additional benefit in terms of quality and price of the best alternative product.

Because lock-in is a two-way street (also involving "lock-out" of customers of other vendors), a strategy of creating lock-in through technical incompatibility is more attractive as the installed base of the vendor grows larger. In the case of the iPod, its high market shares over five years since the launch of iTMS gives it an enormous installed base, estimated to be over 110 million users, over 71 million of which have activated the iPod for use with Internet downloads.[35] Thus, the number of locked-in customers is roughly double the number of consumers who are locked out.

The extent to which iPod users are locked in may not be affected by the switch of competitors of iTMS to DRM-free audio downloads. iTMS has sold over five billion audio recordings,[36] or about 70 per activated iPod. Most of these files are in the DRM-protected FairPlay format. Even though iTMS now sells EMI downloads without DRM protection, it charges its customers for converting old EMI recordings to the unprotected format. Thus, a typical iPod owner is likely to have many recordings that can not be played on competing brand of portable digital media player. A consumer who buys a competing portable digital media player is forced either to abandon playing them or to engage in costly actions to make them compatible with another portable digital player. Switching costs like this are the cause of lock-in, and increase market power because they enable the vendor of the pocked-in product to raise price above the competitive level by any amount less than the switching cost without losing customers.

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[35] Robert Sample, Stephanie Sun and Thompson Wu, "Happy Holidays!" Credit Suisse, October 3, 2007.

[36] "iTunes Store Tops Over Five Billion Songs Sold," Apple Press Release, June 19, 2008.

Costly creation of lock-in with no performance benefit for consumers is anticompetitive because it imposes costs on both society and the firm that pursues it while providing no offsetting benefits to consumers. Proof that technical incompatibility is anticompetitive involves evidence about product performance and costs that apply equally to all customers of each product, and so is common to all class members.

Harm to Competition

In antitrust economics, "harm to competition" by a seller with market power refers to reductions in the welfare of consumers. In this litigation one alleged harm to consumers is higher prices for iPods. The *Complaint* alleges that the prices of iPods were higher than they would have been in the absence of the defendant's anticompetitive acts to prevent consumers who owned competing digital players from acquiring digital recordings from competitors of iTunes. This effect is the source of damages, so the discussion of the quantification of this harm is discussed in the section about damages.

Consumers also can suffer financial harm in ways that normally are not included in the calculation of damages. One example is the "dead-weight loss" arising from higher prices.[37] Dead-weight loss is the loss of welfare arising from the reduction in output that occurs when prices exceed the incremental cost of production. An approximation of dead-weight loss is ½(Pm – Pc)(Qc – Qm), which Pm and Pc are the prices under monopoly and competition, and Qm and Qc are the quantities sold under monopoly and competition.

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[37] Christoper R. Leslie, "Antitrust Damages and Deadweight Loss," *Antitrust Bulletin*, Vol. 51, No. 3 (Sept. 2006).

Another harm to consumers is that the defendant's anticompetitive acts may reduce the intensity of competition among other firms in the market. These firms may charge higher prices for other products in the relevant market, either because they can not take away a significant amount of business from dominant incumbents by lowering price or because the market power of dominant firms prevents them from achieving scale economies that would lead to lower prices if the market were more competitive.

In addition, consumers can be harmed in ways that can not reliably be expressed in monetary terms. Technical incompatibility and lock-in harm competition by reducing the choices available to consumers. A consumer whose iPod is obsolete or no longer functional and who previously bought DRM-protected downloads from iTMS for use in the defunct iPod can not switch to another portable digital media player without taking one of three costly actions. First, the consumer can abandon the use of these downloads on a portable digital player, thereby in essence throwing away otherwise useful recordings. Second, a consumer can repurchase the same recordings from another vendor at a substantial cost (approximately $1 per recording). Third, the consumer can make physical copies of these recordings and then read them back into a personal computer as DRM-free files – assuming the consumer has purchased the electronic equipment necessary to pursue this path. To the extent that some consumers have undertaken one of these costly acts in order to switch, the costs are another anticompetitive harm arising from technical incompatibility.

Another harm to competition arises from the effect of lock-in on technological progress. The incentive to innovate is derived from the sales that a firm expects if it produces a new product. Lock-in reduces a competitor's prospective sales from product innovation because switching costs drive a wedge between the value of the new product that would induce locked-in customers to switch and the lower value of the established, less desirable produce. Hence, lock-in reduces the incentive to innovate. Thus, if the plaintiffs' allegations are true, technological innovation will be slower in all relevant markets than if competition were more intense.

The evidence to establish these harms to competition applies to product features and market outcomes (prices, sales, and entry and exit by competitors). Examples are consumer surveys about decisions to replace a portable digital player and to patronize a particular online seller of legal downloads, informed opinions by industry participants and the trade press about product quality and the adoption of new technologies by vendors, data about costs, prices and quality of competitive products, and histories of competitive products. All of this information is common to all class members.

Business Justifications

A business justification is a benefit to consumers arising from an act that also had the effect of reducing competition. Higher profits and greater sales are *not* business justifications. Instead, an act can be reasonable if it provides consumer benefits that can not by obtained by any reasonable alternative, less anticompetitive means.

This litigation has not yet proceeded to the stage at which the defendant would offer detailed business justification for its alleged anticompetitive acts. In *Defendant Apple Inc.'s Answer and Defenses to Plaintiffs' Consolidated Complaint*, Apple briefly refers to possible business defenses by stating that any adverse effects of the defendant's activities on competition "were outweighed by the pro-competitive benefits..." In the *Motion to Dismiss*, defendant's state that "making complementary, innovative products that work seamlessly together is a plus for consumers…"

Because these statements at best hint at a detailed business justification, it is premature to reach conclusions about how these justifications would be proved or refuted. But typically in matters involving tying, bundling and technical incompatibility, the business justifications are related to product quality. One common claim that seems to be the substance of the statement from the *Motion to Dismiss* is that product quality is higher because of the greater integration of the technologies underpinning a family of products that must be interoperable ("work seamlessly together"). Another common claim is that consumers benefit if a single vendor can be held accountable for the quality of the performance of a group of complementary products. A third common claim is that technical incompatibility is necessary to protect the intellectual property of the vendor in one or more products.

For example, in *U. S. v. Microsoft*, the defendant argued that it tied Internet Explorer to its Windows operating system for the purpose of technically integrating the two products and thereby providing higher quality. The plaintiff, the U. S. government, contested this claim by arguing that Internet Explorer was not integrated in any meaningful way into Windows, and in any case that bundling the two together actually reduced the quality of Windows.[38]

Regardless of the merits of business justification claims in this matter, their validity would be resolved by analyzing the technical characteristics and performance of products in the relevant markets. Most competitors do not sell products in all of the relevant markets. Only Apple and Microsoft sell products in each relevant market that are technically incompatible with the products of competitors.[39] The analysis of business justifications would address whether consumers are harmed by having the opportunity to deal with multiple vendors for each product (rather than only for the group of products), and whether the opportunity for choice among vendors of products in each relevant market offsets the benefit, of any, of integration from a single vendor. Also relevant is whether consumers need vendors to protect them against considering and then rejecting the defendant's marketing message that seamless integration is valuable. The analysis also would examine whether firms that sell products that are compatible with products in other markets from other vendors have experienced greater difficulty in protecting their intellectual property. The focus of all of this analysis is products and markets in a complementary system, and so is common to all class members.

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[38] For a more complete discussion of this issue, see *Findings of Fact*, *U. S. v. Microsoft*, U. S. District Court for the District of Columbia, and the decision in the same matter by the U. S. Court of Appeals for the District of Columbia.

[39] Initially, Microsoft's Windows media player software, online music store, and Zune portable digital media player were compatible with the products of all vendors in the relevant markets other than Apple. In 2006, Microsoft developed new versions of all three products, all named Zune, that, like Apple's products, are incompatible with the products of other vendors, and closed its MSN Music Store, which had sold downloads in DRM-protected recordings in the WMA and WMV formats.

DAMAGES

In antitrust economics, damages are calculated by comparing actual prices for the reference product with prices that would have been charged in the "but-for" world in which the alleged anticompetitive acts had not occurred. A damage analysis estimates prices in a hypothetical more competitive market – the "competitive benchmark" – that would have been present during the historical period that damages occurred. In discussing the methods for calculating damages, I assume that plaintiffs' allegations about market definition, market power, sources of market power, and harms to competition have been proved, and that the remaining task is to quantify the effect of the defendant's anticompetitive acts on the prices paid by class members.

In analyzing damages in this matter, the task is to calculate the extent to which the alleged anticompetitive acts enabled the defendant to set higher prices for iPods than otherwise would have been charged if the market for portable digital media players had been more competitive. The competitive benchmark is not necessarily an intensely competitive market. Instead, it represents the degree of competition that would have been present had the anticompetitive acts not occurred, which in some circumstances is an oligopoly. Thus, a valid damage analysis must take into account that in the absence of the anticompetitive acts, Apple still may have enjoyed some market power in iPods.

The class includes both end-users and intermediaries who bought iPods from the defendant. These two types of customers paid different prices. Consumers paid retail prices from the online or traditional retail outlets of the Apple Store, while the retail competitors of the Apple Store paid wholesale prices from Apple's wholesale distribution operations. Consequently, the method for calculating damages may need to incorporate whether the product is sold at retail or wholesale. If markets are competitive, the wholesale and retail prices of a firm that operates in both markets differ according to the firm's sales costs in the two distribution channels; however, a firm that enjoys market power in manufacturing may have the power to engage in effective price discrimination among categories of buyers. Consequently, the amount of damages per unit sold may differ between retail and wholesale buyers.

Apple's sales of iPods at retail are made at posted prices to all consumers who choose to buy directly from the defendant. The defendant is likely to have records of its retail prices for iPods, but even if the defendant does not produce these data, prices of iPod models are reported in Apple press releases that are publicly accessible on the defendant's web site and in the trade press, so that an approximation of actual retail prices throughout the period can be obtained from public sources.

For wholesale transactions, manufacturers of consumer electronics normally sell products at wholesale list prices, but offer quantity discounts and sometimes special discounts to dispose of excess inventories or advance purchase commitments.[40] The net price after these discounts is appropriate for undertaking a damages analysis. For large firms like Apple, wholesale transactions records normally identify the purchaser and show actual transactions prices and quantities for each product by model. These data then can be used to undertake a damages analysis that can take into account the type of customer and the age and the model.

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[40] The defendant also may offer promotional discounts, but these should not be subtracted from the wholesale price because they reimburse the customer for the cost of advertising the defendant's products.

The method for calculating damages in this matter also must take into account the fact that portable digital media players, like all consumer electronics products, are undergoing rapid technological progress in both features and inputs. Consequently, damages may vary considerably during the class period due to changes in the features of iPods that arise from technological progress. To take this possibility into account, the damage method can include measures of the technology that is used in a model at any given time or differences in feature among models. Separate damages can be calculated for each relatively short time interval during the class period. In selecting the appropriate time interval, economists must take into account data availability, but if data availability posses no barriers, the choice must balance greater accuracy of estimation and greater cost of estimation arising from shorter time intervals. For mass-produced information technology products that are sold by large firms, my experience is that a reasonable choice of an interval is a month or a quarter.

Economists use three basic approaches to estimating competitive benchmark prices: "before-after," "yardstick," and "mark-up."[41] I conclude that all of these methods can be implemented in this case. Although identification of the most reliable method depends in part on the results of further discovery, my expectation is that the yardstick method would be most difficult to implement because of data requirements. I also conclude that each method would involve data and analysis that would be predominantly common to all class members.

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[41] The first two methods are described in John Johnson, "Economic Approaches to Antitrust Damage Estimation," National Economic Research Associates, January 2005. All three methods (with the mark-up approach separated into three ways that it can be implemented) are discussed in John M. Connors, "Foresnsic Economics: An Introduction with Special Reference on Price Fixing," *Journal of Competition Law and Policy*, Vol. 4,

Before-After Method

The "before-after" method compares prices of the reference product before and/or after the occurrence of the anticompetitive acts with prices during the damage period. Here this method would compare iPod prices before and after April 2003. This method requires information about retail posted prices and wholesale transactions prices for each model of iPod with the dates when each price was charged.

Digital media players vary in their technical characteristics and, like all electronics products, experience rapid technological progress. To take technology into account, economists undertake a regression analysis that explains the price of a product model in each time period as a function of product features, input costs, and the stage of the product in its life-cycle. In addition, the demand for iPods is likely to depend on the digital downloads that are available, so that one factor affecting price changes over time may be the number of permanent downloads that are available on iTMS.

Among large consumer electronics firms, transactions prices frequently include discounts, so that the method for estimating the effect of an anticompetitive act on wholesale prices may require econometric estimation of a model in which an observation

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is a transaction. Discovery will determine Apple's policies regarding wholesale pricing, which in turn will determine precisely how a before-after test is implemented.

If discovery and further data analysis indicate that wholesale and retail prices must be estimated in separate regression models, the two equations will contain the same independent variables concerning model characteristics and market conditions. The differences between the two equations will be that they are based on different prices (retail or wholesale) and that the wholesale equation may include characteristics of the transaction, such as sales volume and, if under contract, terms of the contract. For every class member one of the two regressions will be used to calculate damages. Thus, damages for all retail customers will be derived from a common formula, as will damages for all wholesale customers.

Yardstick Method

The "yardstick" method estimates the competitive benchmark from the prices of other products that are subject to similar underlying market forces except for the effects of the anticompetitive acts. The validity of this method depends on identifying other consumer electronics products that have similar technical capabilities and that plausibly have a market structure that is similar to the market structure for portable digital players that would have arisen in the but-for world, but that are sold in markets are not affected by anticompetitive acts.

The best candidates for yardstick comparison are products that are technically and functionally similar to iPods. Several products plausibly can serve as benchmarks for at least part of the damages period. One candidate is smart mobile telephones that do not have sufficient memory and power to be used as portable digital media players, but that can be used to access the Internet for streaming audio and video. Another candidate is a personal digital assistant (PDA) that is not equipped to be a mobile telephone and that does not have sufficient memory to be used as a portable digital media player, but that can be used as a small personal computer, has access to the Internet, and can be used for streaming entertainment. Both of these products have converged in 3G mobile telephones, which are not appropriate yardsticks because they also are portable digital media players. Another candidate is portable CD/DVD players with small screens, such as the Cody TF-DVD500 3.5 inch Portable DVD player.

Normally other products that are sold in the same market can not be used as yardsticks for a reference product. In the case of a dominant firm with a competitive fringe, which is the market structure implied by the plaintiffs allegations, fringe firms simply follow the price leadership of the dominant firm so that all prices are elevated equally. Nevertheless, conceivably this case could be an exception. If lock-in of consumers of Apple's reference products is the over-riding factor explaining performance in the relevant market, it is possible that other firms in the market for portable digital players compete intensely with each other for customers who are not locked in, while Apple and other vendors of portable digital players do not really compete. If so, prices from fringe firms could be lower than the prices of comparable Apple products, and could provide a lower bound estimate of the effects of the alleged anticompetitive acts.

For the most part, manufacturers of these yardstick products do not have significant direct sales to consumers. Hence, this method requires collecting wholesale price data for these products as well as information about the components of all products to take into account possible differences in input costs. The source of such information is third-party discovery of prices, technical specifications, and manufacturing costs during the class period. These data would then be used to estimate a price equation that includes costs as an explanatory variable. Collecting and analyzing this information would be a major undertaking in terms of complexity, time and costs.

Mark-up Method

The "mark-up" method directly estimates the competitive benchmark mark-up over average operating cost in the but-for world. The competitive benchmarks that economists commonly use are the defendant's mark-ups in more competitive markets, typical mark-ups (operating profits) in the same industry (here, consumer electronics), or the results from a game theoretic model of price formulation in the relevant market.

The first two mark-up approaches use accounting data for revenues and operating costs. Apple has submitted exemplar data about costs that can be used to estimate operating costs and operating margins for iPods. Similar information about operating costs and margins for Apple's other consumer electronics products is likely to be available from the defendant. In addition, product-line financial information is included in the defendant's audited financial reports and can be used to compare operating margins by product line. Likewise, public financial reports of other consumer electronics firms can be used to produce benchmark estimates of profit margins.[42]

To account for the possibility of price discrimination between wholesale and retail

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42 See, for example, "AAPL: Weak Macro Environment; Downgrading on Poor Risk/Reward," Morgan Keegan Company, April 7, 2008.

customers, data about operating margins and costs need to be collected by distribution channel. While each channel has the same direct costs of manufacturing, they may have substantially different sales costs, which need to be taken into account to determine whether Apple engages in wholesale price discrimination between its retail operations and its unaffiliated wholesale customers.

To implement a game-theoretic model of price formulation requires information about the prices and variable production costs of different models of iPods and iPhones at both the wholesale and retail level throughout the data period. Here the wholesale data are used to calculate a wholesale price index for all wholesale customers over the class period. These models calculate the effect of market concentration on the mark-up of price over unit costs. The benchmark prices are calculated using the market concentration in portable digital media players that would have occurred in the absence of the anticompetitive acts. Thus, the validity of the method hinges on accurately estimating market concentration in the but-for world and using a valid theoretical model to characterize the nature of price formation. The former is deduced from the extent of concentration in other consumer electronics markets. The latter normally is based on the Nash-Cournot model of imperfect competition, as calibrated to fit the actual price data given actual market concentration during the damage period.

As with the other methods, the mark-up method will produce two common formulas for calculating damages to retail and wholesale buyers. Each will make use of the same data about product and market characteristics, combined with data about prices and costs in each channel.

I declare that the foregoing is true to the best on my knowledge. Executed on July 15, 2008, in Palo Alto, California.

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Roger G. Noll

I declare that the foregoing is true to the best on my knowledge. Executed on July 15, 2008, in Palo Alto, California.

Roger G. Noll